The Lunar Mapping and Modeling Project

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NASA Marshall Space Flight Center

Project Background and Overview

- LMMP was initiated in 2007 to help in making the anticipated results of the LRO spacecraft **useful** and **accessible** to Constellation
- The LMMP is managing and developing a suite of lunar mapping and modeling tools and products that support the Constellation Program (CxP) and other lunar exploration activities
- In addition to the LRO Principal Investigators, relevant activities and expertise that had already been funded by NASA was identified at ARC, CRREL (Army Cold Regions Research & Engineering Laboratory), GSFC, JPL, & USGS
- LMMP is a cost capped, design-to-cost project (Project budget was established prior to obtaining Constellation needs)

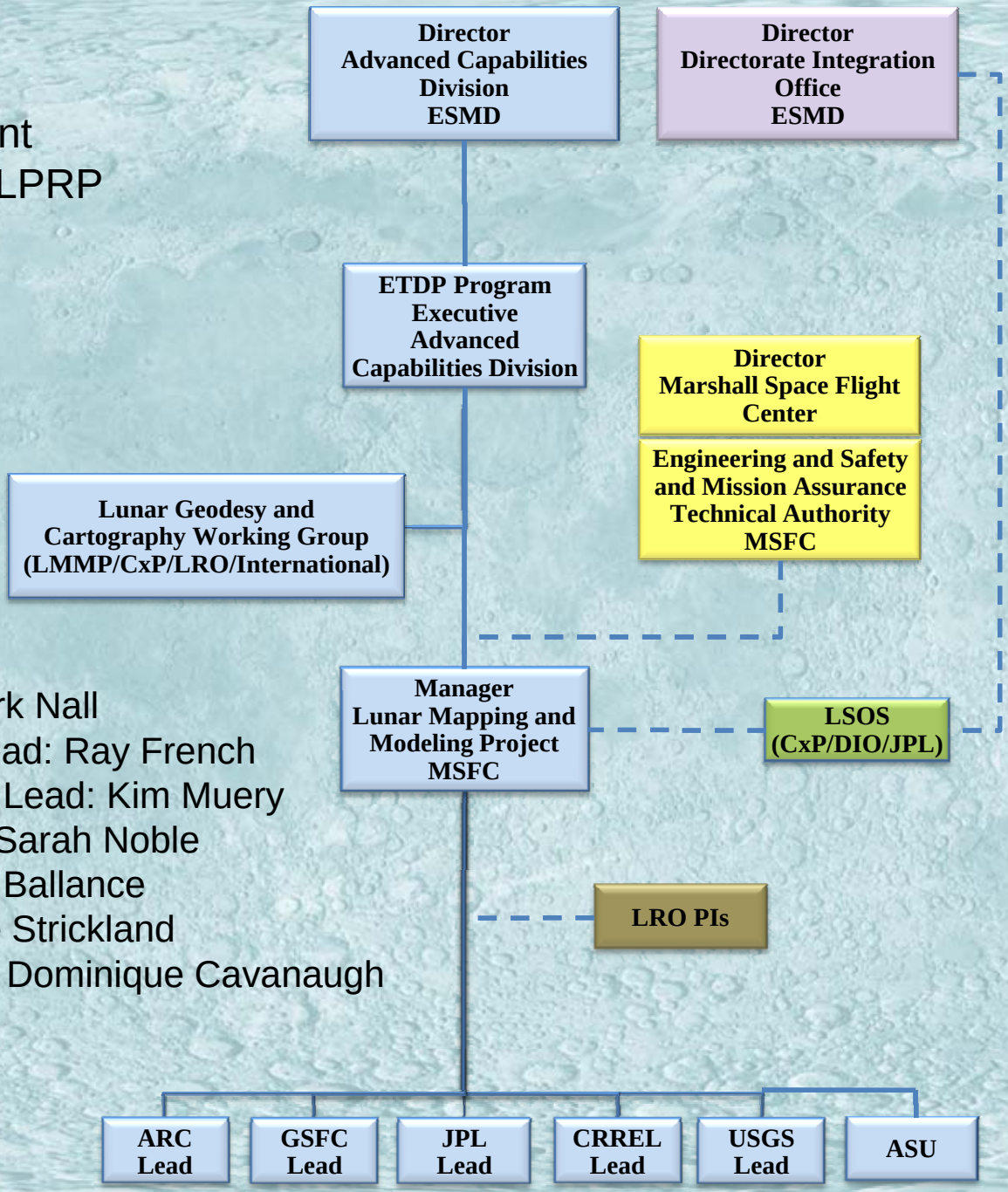
Customers

- Main customer is the Constellation program

  The information provided through LMMP will assist them in:
  - planning tasks in the areas of landing site evaluation and selection
  - design and placement of landers and other stationary assets
  - design of rovers and other mobile assets
  - developing terrain-relative navigation (TRN) capabilities
  - assessment and planning of science traverses
- Other customers
  - Science community
  - Commercial community (e.g. GLXP teams)
  - Education/Public Outreach community

Management Structure Post LPRP

FY 2010-11



MSFC Team:

- Project Manager: Mark Nall
- Project Integration Lead: Ray French
- Project Development Lead: Kim Muery
- Project Scientist: Dr. Sarah Noble
- Chief Engineer: Judy Ballance
- S&MA TA: Rosalynne Strickland
- Scheduling and Risk: Dominique Cavanaugh

LMMP Team

ARC
- Regional Apollo visible base imagery mosaics
- Regional DEMs
- EPO web-based neo-geography interfaces

USGS
- Local/site visible base imagery mosaics
- Regional/polar visible base imagery mosaics
- Local/site DEMs

JPL
- Visualization system infrastructure, web portal and interoperable GIS infrastructure
- Local/site DEMs (stereo photoclinometry)
- Hazard assessment maps (including slope maps)

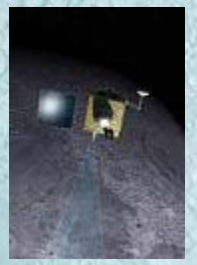
ASU
- Local/site DEMs

CRREL
- Web-based visualization system digital overlay tools

GSFC
- Desktop visualization client – Integrated Lunar Information Architecture for Decision Support

Data Sources

- LRO
- M3
- Kaguya (gravity model)
- Apollo (metric & panoramic cameras)
- Clementine
- Prospector



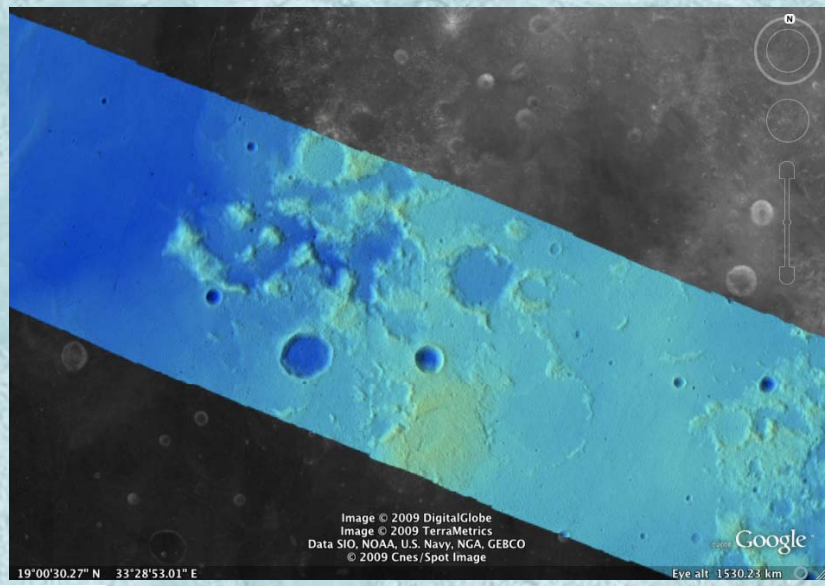
Data Products

- "Passthrough"
  - e.g. LOLA DEM, Clementine, Prospector, gravity model, lighting model
- Modify
  - e.g. mosaicking basemap, georeferencing local images
- Create…

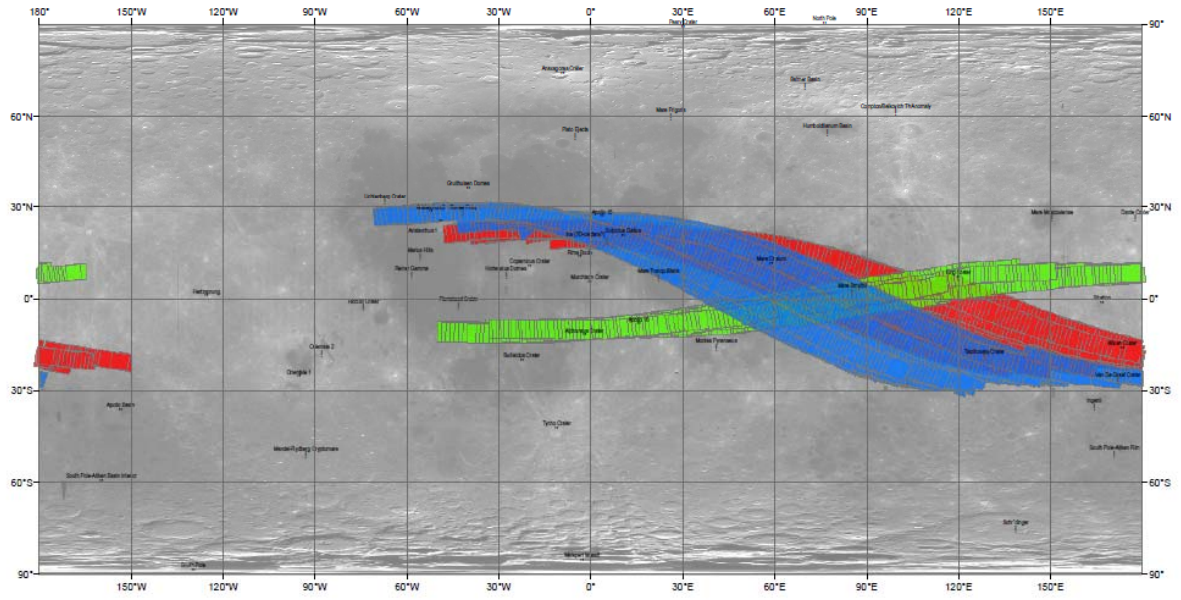
Created Products - DEMs

Regional DEMs using scanned Apollo metric camera data

Covers ~18% of the Moon (low latitudes)



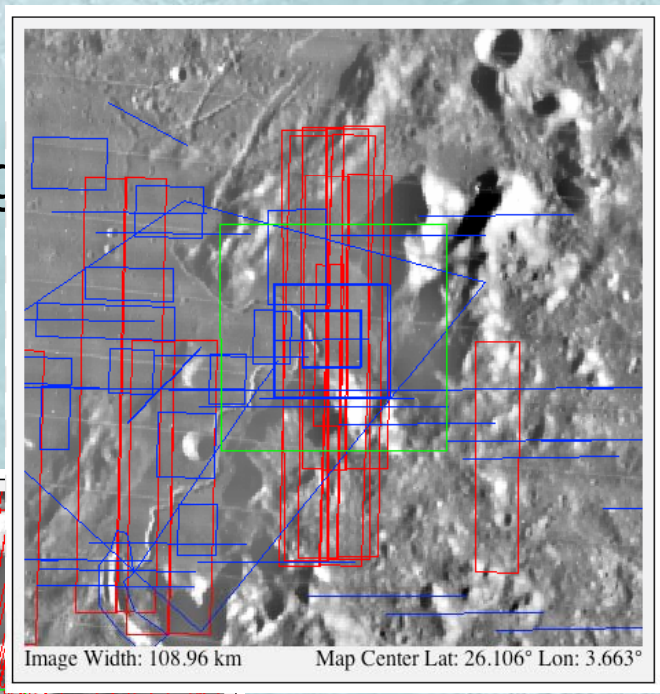
Small section of DEM from orbit 33. DEM resolution ~40m/pixel

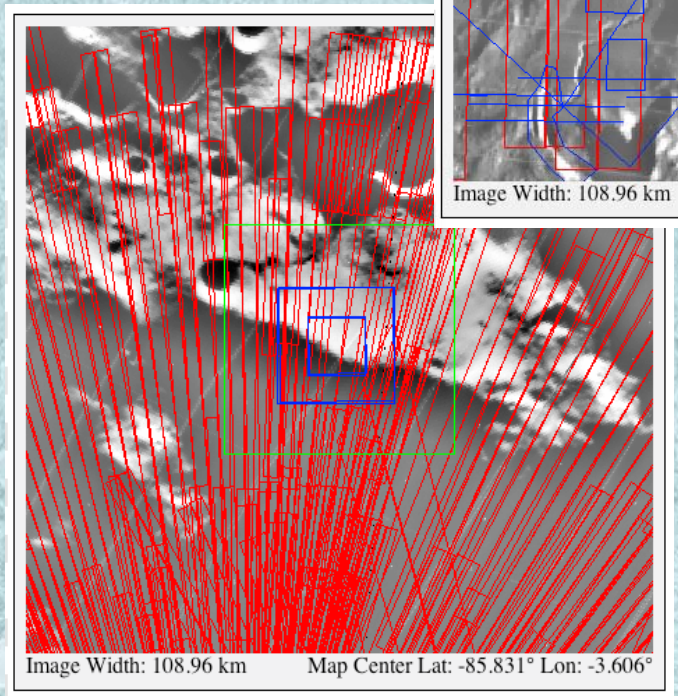


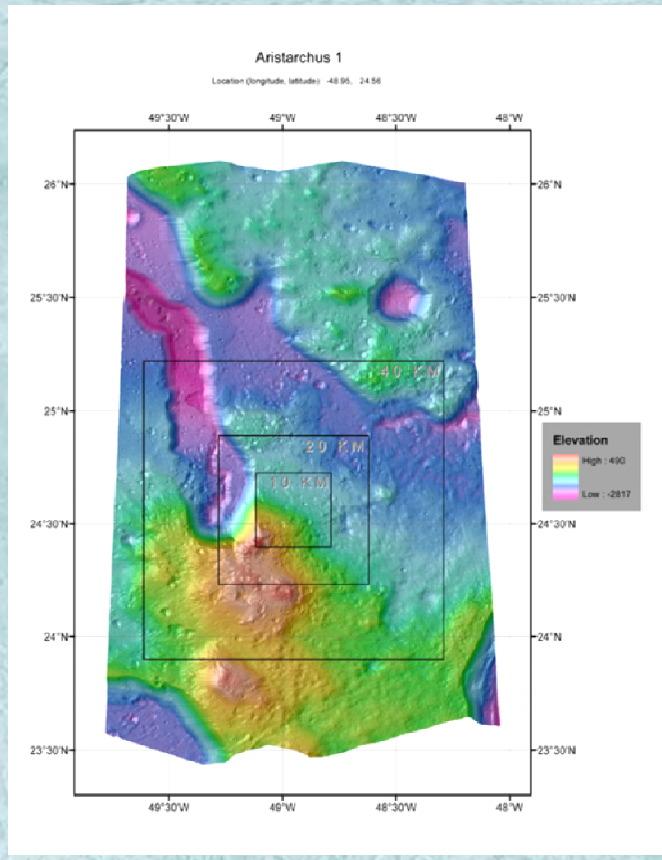
Map showing coverage of metric camera data

DEMs

Local DEMs from LOLA NAC covering the 50 CxP regions of interest





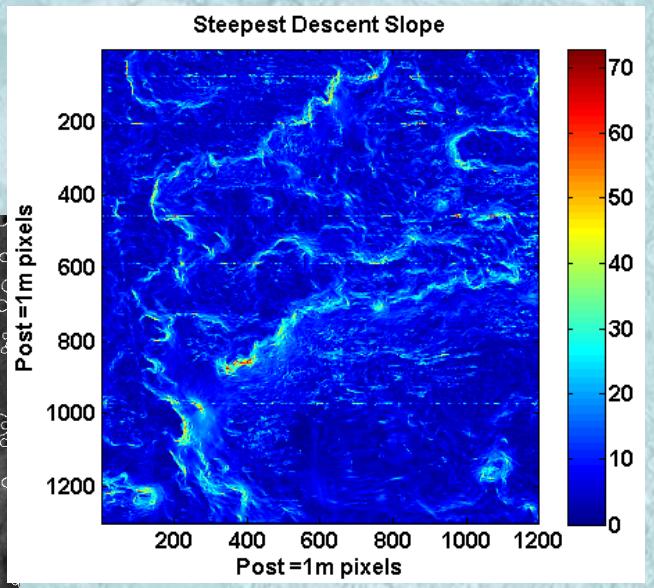


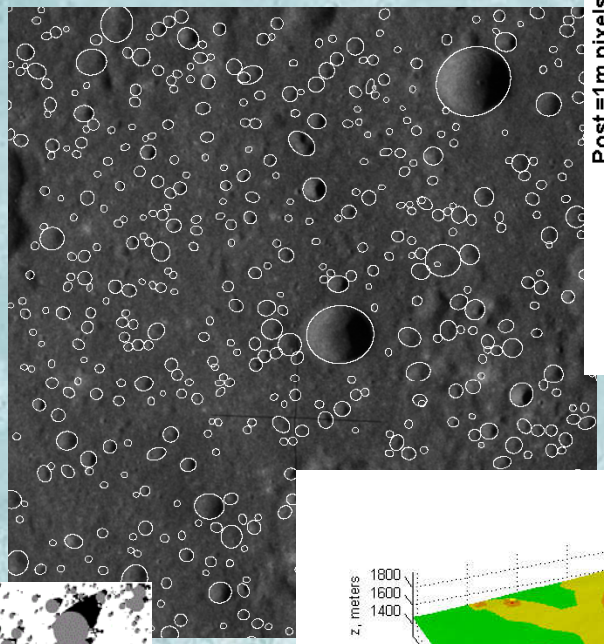
Preliminary USGS Aristarchus Plateau (DEM 1) from JSC/ASU Apollo Pan Cam Scans

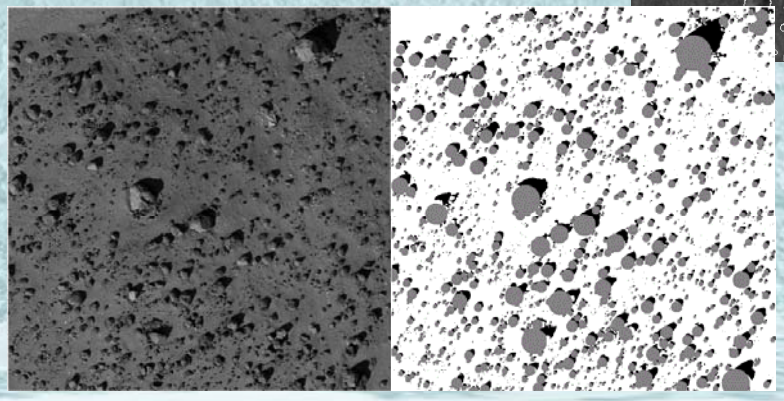
Malapert (left) and Ap 15 (right) ROIs showing in red the NAC images acquired through the 1st month of mapping orbit

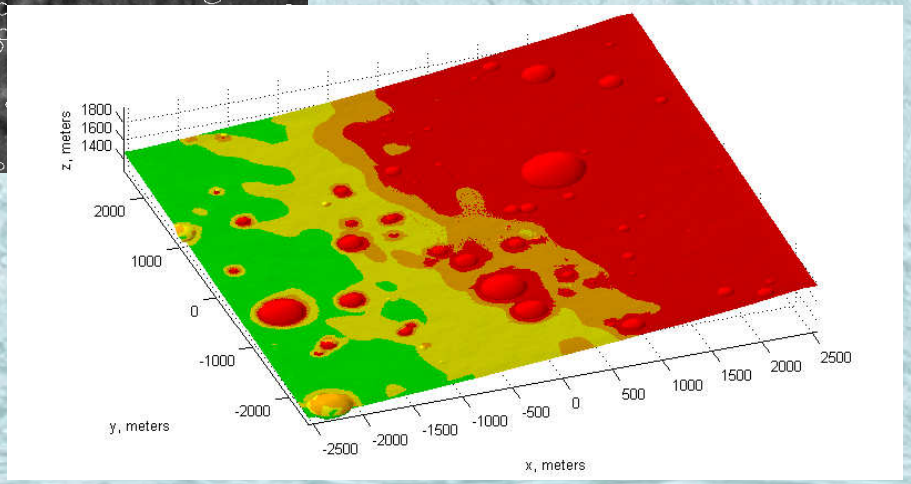
Created Products - Hazard Maps

- Craters
- Boulders
- Slopes
- Surface Roughness

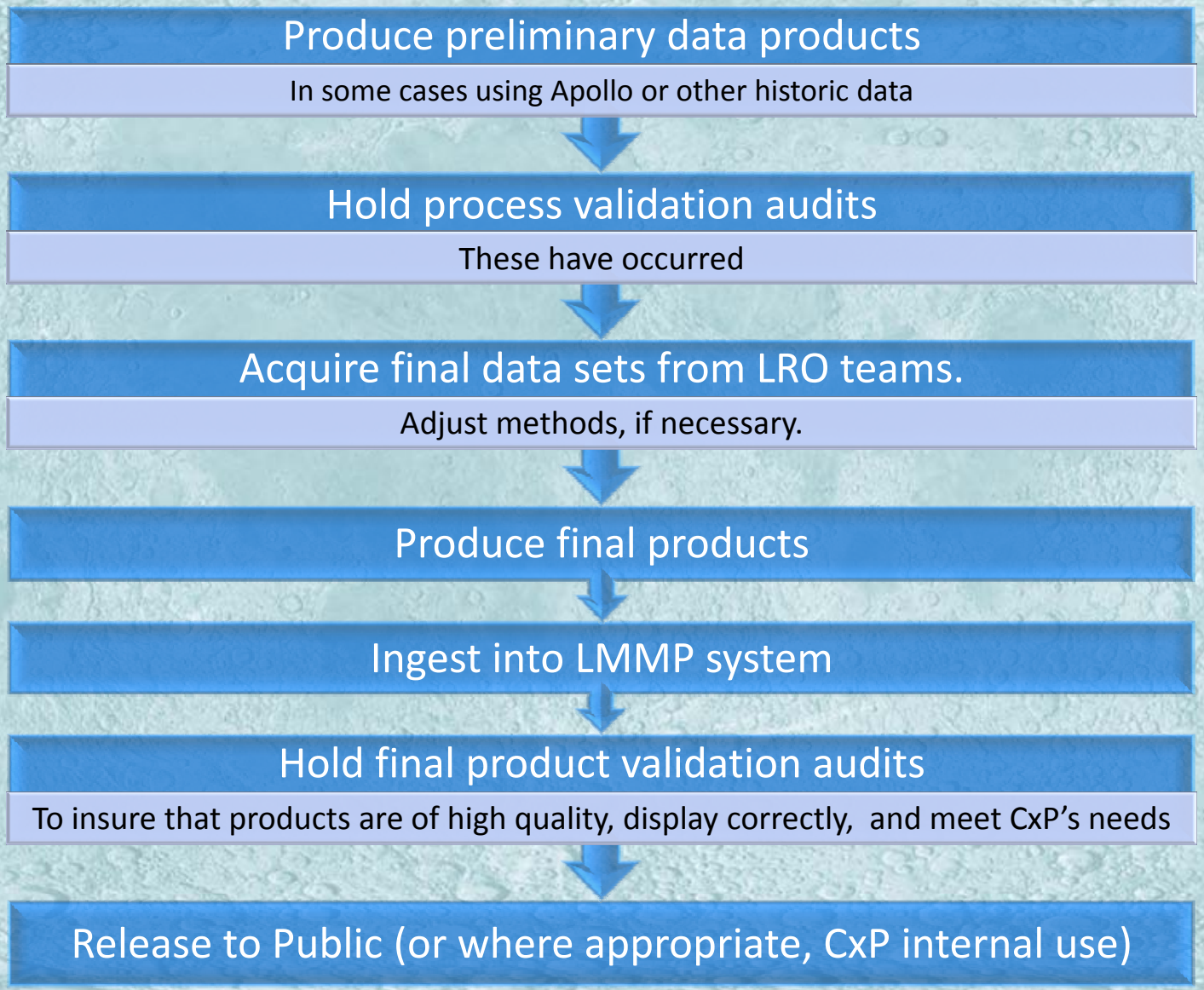




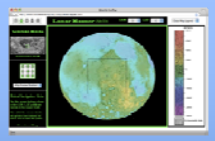




Data Products Process



LMMP System



LunarMapper

ILIADS

STK

GoogleEarth

ArcGIS

X-GIS

GIS

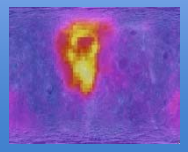
LMMP Portal

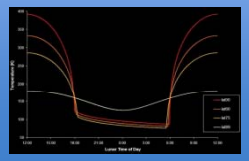
Data Processing | Ingestion | Authentication | Validation | Data Distribution

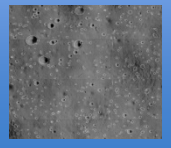
Data Products

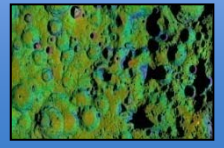
Nomenclature | Gravity | Hazards | Surface Roughness

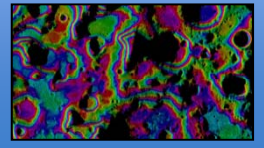
Imagery | Mineralogy | Temperature | Rock & Craters | Slopes | Contours | Elevation

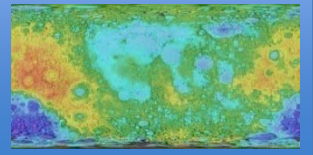




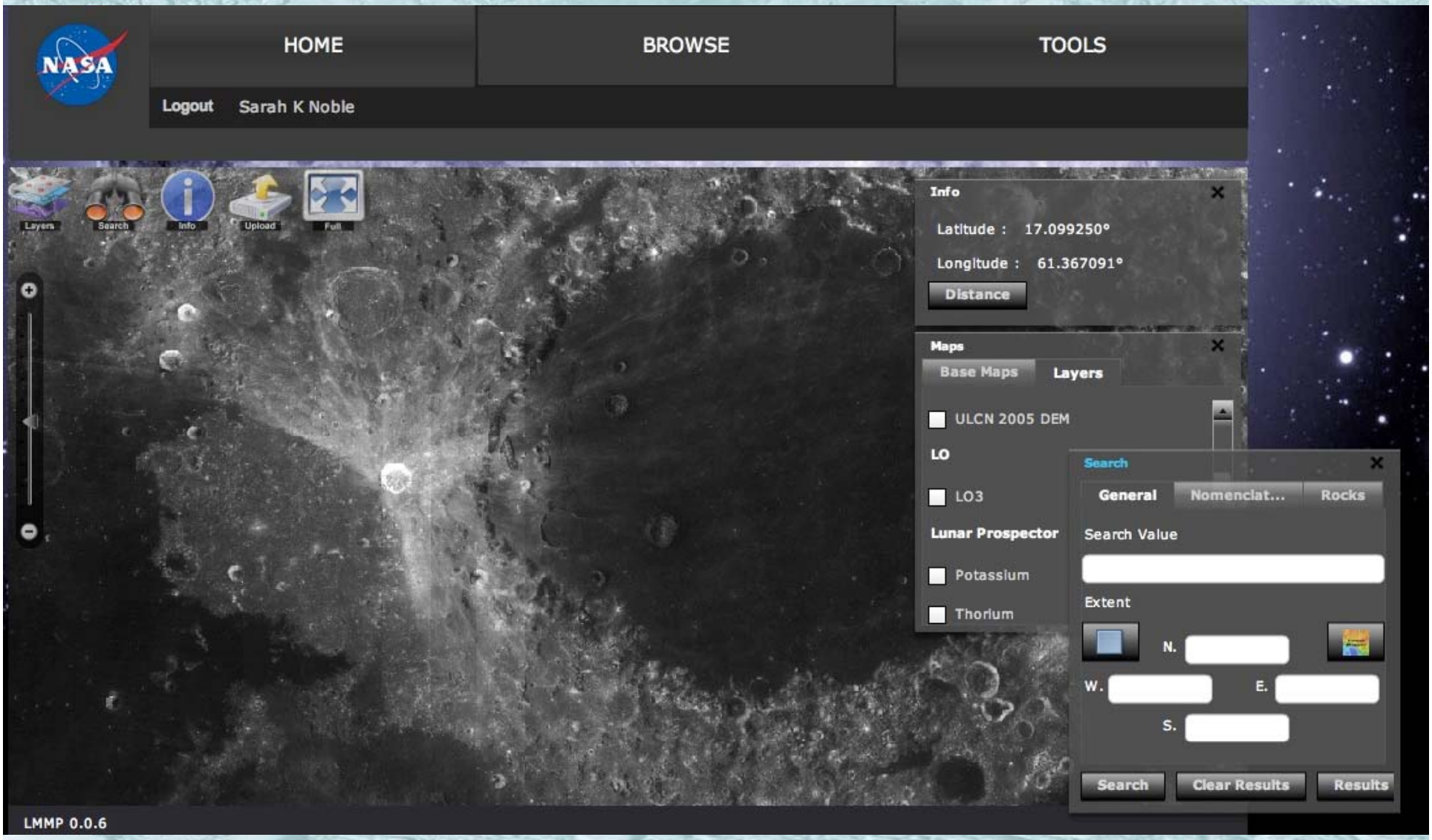








Portal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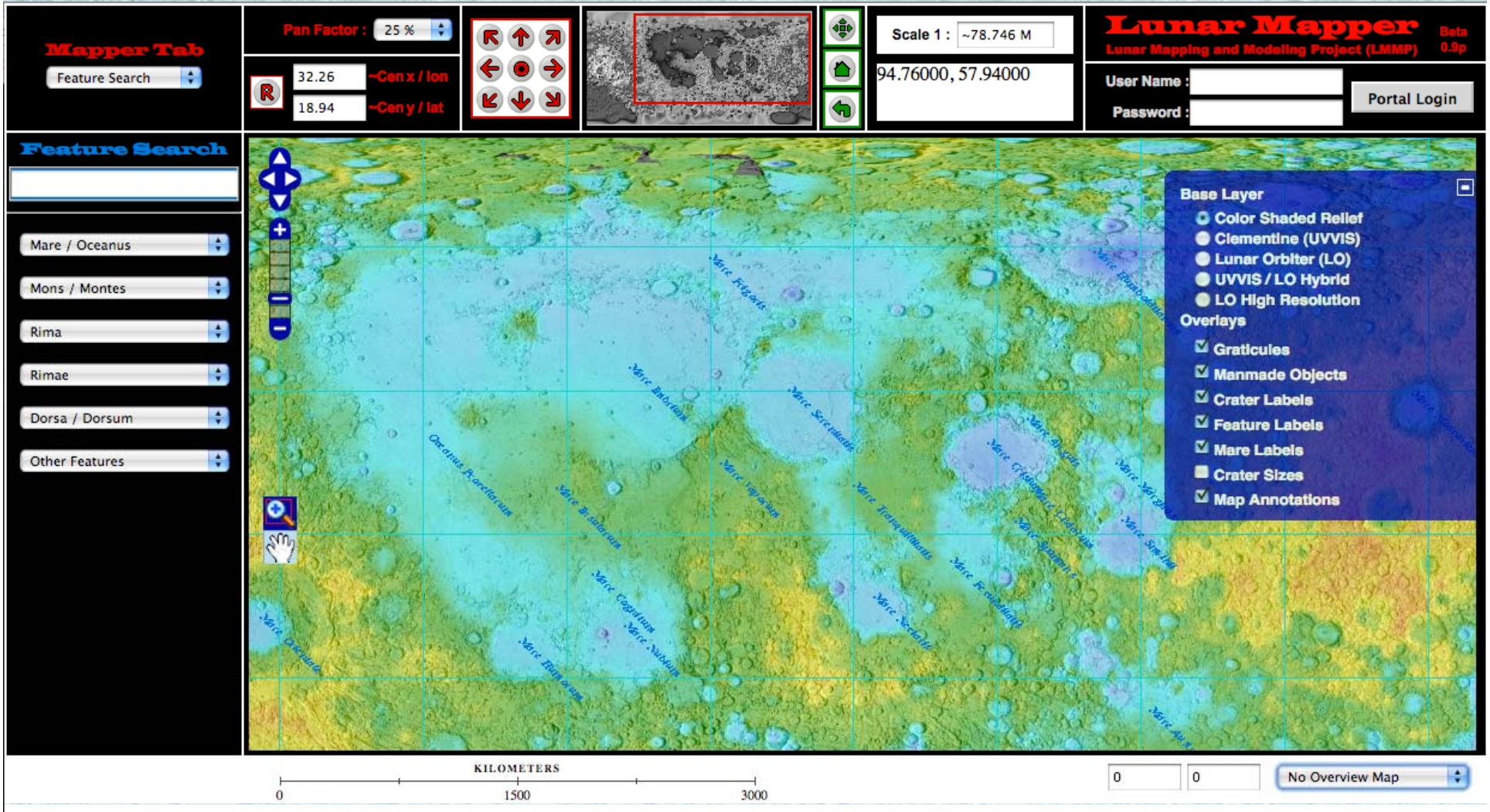
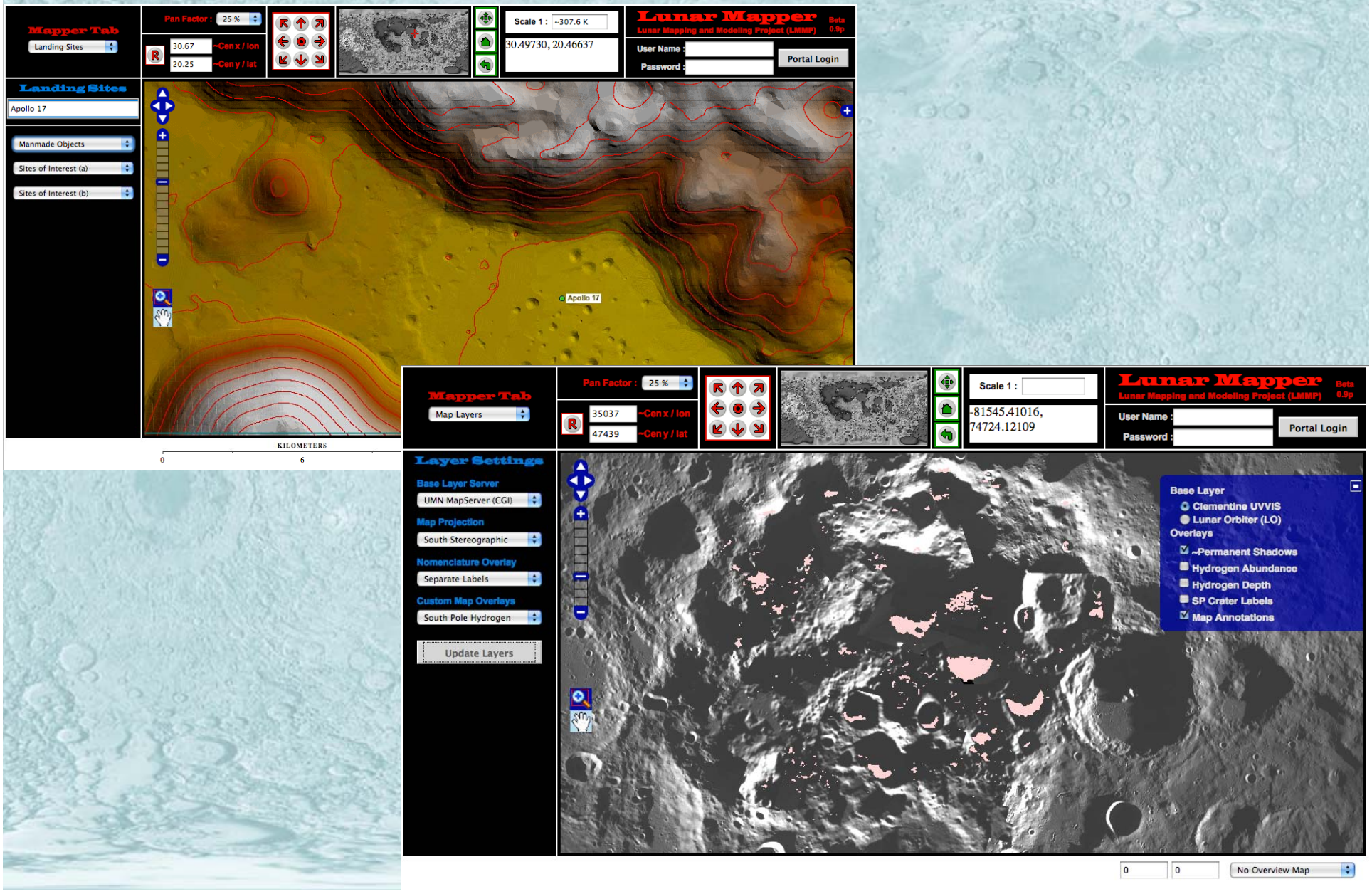
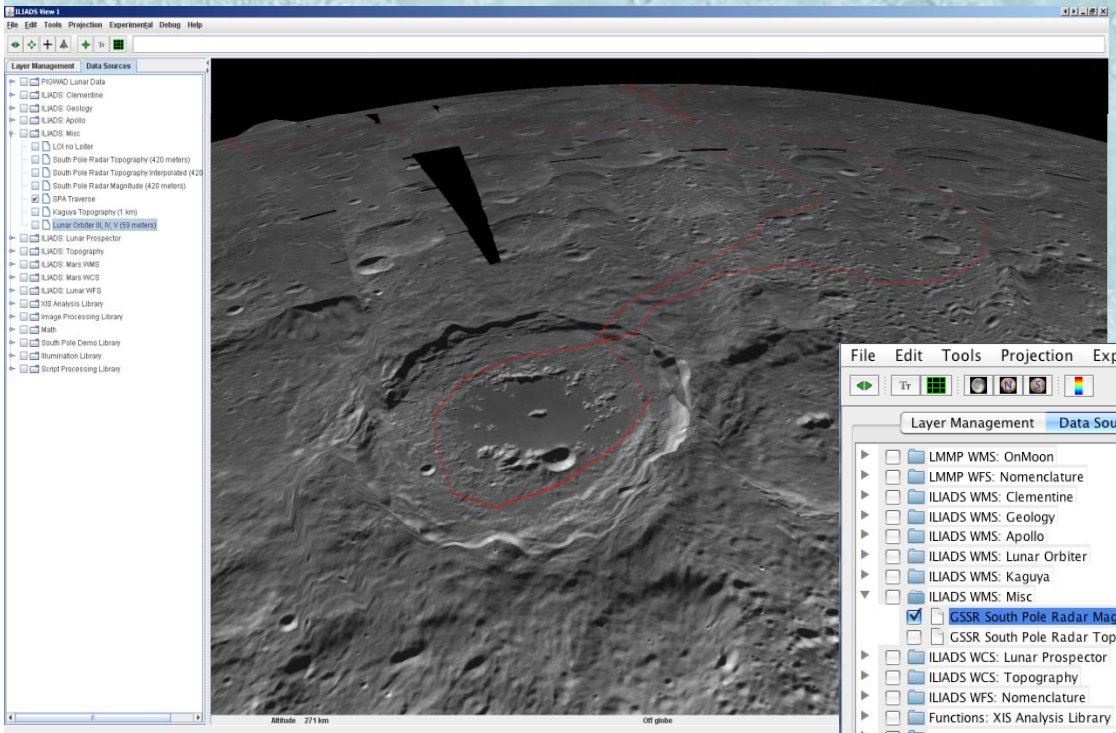
Lunar Mapper



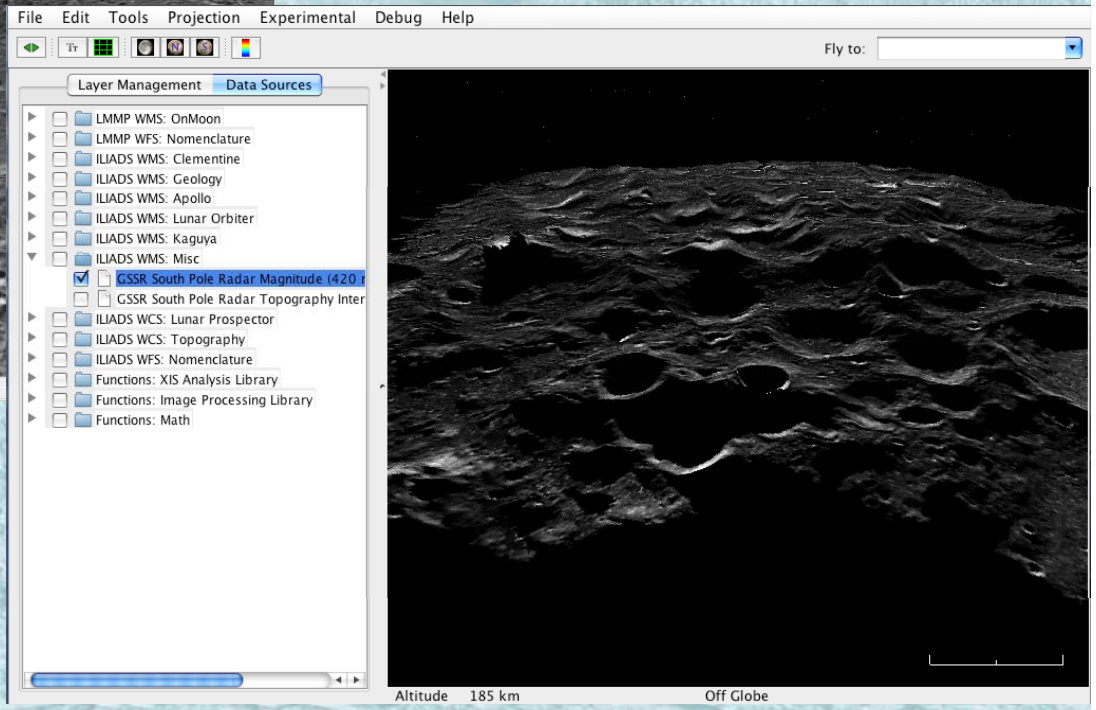
Lunar Mapper



Integrated Lunar Information Architecture for Decision Support (ILIADS)

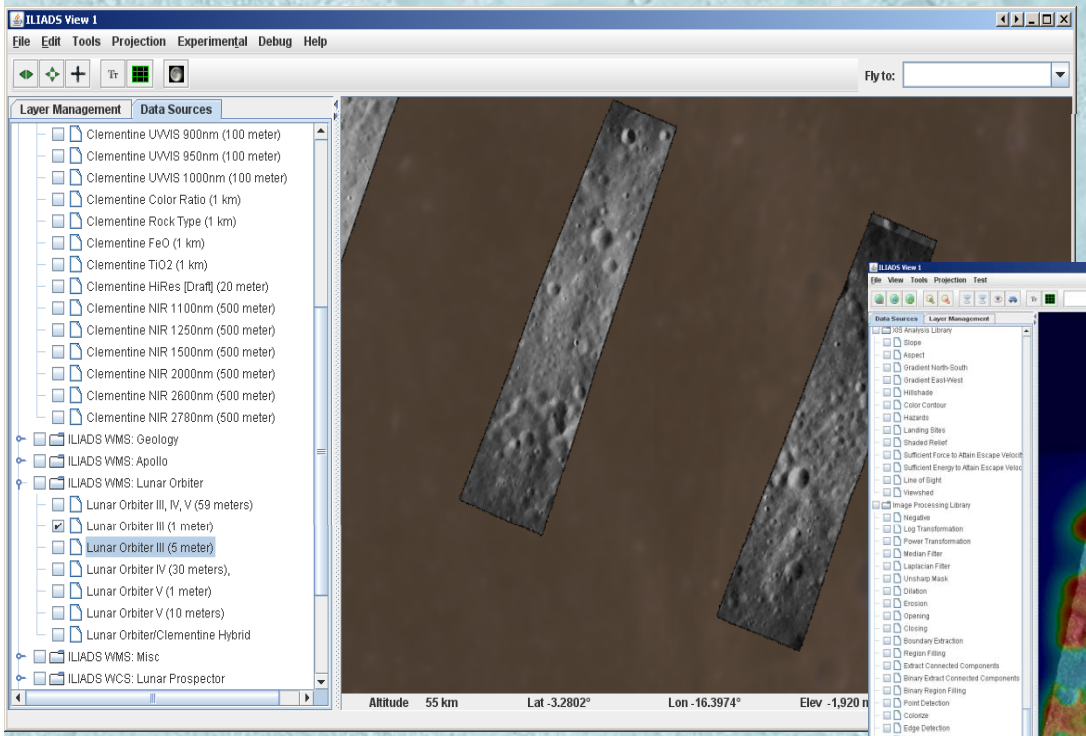


Lunar Surface Traverse Tool (oblique view)

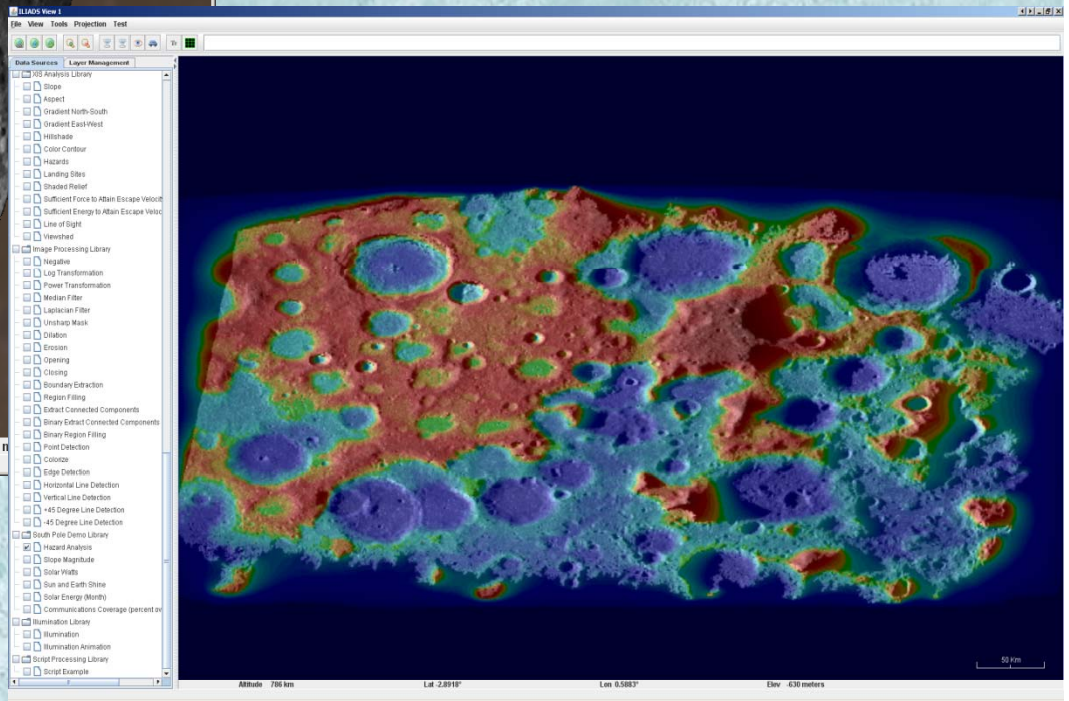


Goldstone Radar of South Pole (oblique view)

Integrated Lunar Information Architecture for Decision Support (ILIADS)



Clementine with high-res Lunar Orbiter



South Pole hazard analysis (surface roughness)

LMMP Milestones

- Apr 2009 – Formulation review
- Jun 2009 – LRO launched!
- Jun 2009 – Requirements review
- Aug-Sep 2009 – Individual product process validation audits
- Sep 2009 – Preliminary System design audit
- Dec 3rd 2009 – Beta release of Mapper, ILIADS, Portal, infrastructure and content
- Late 2010/Early 2011 – Version 1 release